**DG808BC45**

Gate Turn-off Thyristor

Replaces DS5914-1  DS5914-2  July 2014  (LN31731)

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**FEATURES**

- Double Side Cooling
- High Reliability In Service
- High Voltage Capability
- Fault Protection Without Fuses
- High Surge Current Capability
- Turn-off Capability Allows Reduction in Equipment Size and Weight. Low Noise Emission Reduces Acoustic Cladding Necessary For Environmental Requirements

**APPLICATIONS**

- Variable speed AC motor drive inverters (VSD-AC) including Traction drives
- Uninterruptable Power Supplies
- High Voltage Converters
- Choppers
- Welding
- Induction Heating
- DC/DC Converters

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**KEY PARAMETERS**

- $I_{TCM}$: 3000A
- $V_{DRM}$: 4500V
- $I_{(AV)}$: 780A
- $dV_{dr}/dt^*$: 1000V/µs
- $dl_{r}/dt$: 400A/µs

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**VOLTAGE RATINGS**

<table>
<thead>
<tr>
<th>Type Number</th>
<th>Repetitive Peak Off-state Voltage $V_{DRM}$ (V)</th>
<th>Repetitive Peak Reverse Voltage $V_{RRM}$ (V)</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG808BC45</td>
<td>4500</td>
<td>16</td>
<td>$T_{vj} = 125^\circ C$, $I_{DM} = 100mA$, $I_{RRM} = 50mA$</td>
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---

**CURRENT RATINGS**

<table>
<thead>
<tr>
<th>Symbol</th>
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<th>Conditions</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{TCM}$</td>
<td>Repetitive peak controllable on-state current</td>
<td>$V_D = 66%V_{DRM}$, $T_j = 125^\circ C$, $dl_{GQ}/dt = 40A/\mu s$, $C_S = 4 \mu F$</td>
<td>3000</td>
<td>A</td>
</tr>
<tr>
<td>$I_{(AV)}$</td>
<td>Mean on-state current</td>
<td>$T_{HS} = 80^\circ C$, Double side cooled. Half sine 50Hz</td>
<td>780</td>
<td>A</td>
</tr>
<tr>
<td>$I_{(RMS)}$</td>
<td>RMS on-state current</td>
<td>$T_{HS} = 80^\circ C$, Double side cooled. Half sine 50Hz</td>
<td>1225</td>
<td>A</td>
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</tbody>
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<td>A</td>
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</tbody>
</table>
## SURGE RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITSM</td>
<td>Surge (non repetitive) on-state current</td>
<td>10ms half sine. $T_j = 125^\circ C$</td>
<td>16.0</td>
<td>kA</td>
</tr>
<tr>
<td>$i^2t$</td>
<td>$i^2t$ for fusing</td>
<td>10ms half sine. $T_j = 125^\circ C$</td>
<td>1.28</td>
<td>MA^2s</td>
</tr>
<tr>
<td>dI/dt</td>
<td>Critical rate of rise of on-state current</td>
<td>$V_D = 3000V$, $I_T = 3000A$, $T_j = 125^\circ C$, $I_{FG} &gt; 40A$, Rise time &gt; 1.0 $\mu$s</td>
<td>400</td>
<td>A/$\mu$s</td>
</tr>
<tr>
<td>dV/dt</td>
<td>Rate of rise of off-state voltage</td>
<td>To 66% $V_{DRM}$, $R_{GK} \leq 1.5\Omega$, $T_j = 125^\circ C$</td>
<td>100</td>
<td>V/$\mu$s</td>
</tr>
<tr>
<td>L_S</td>
<td>Peak stray inductance in snubber circuit</td>
<td>$I_T = 3000A$, $V_D = V_{DRM}$, $T_j = 125^\circ C$, $dI_{GO} = 40A/us$, $C_S = 4.0\mu F$</td>
<td>200</td>
<td>nH</td>
</tr>
</tbody>
</table>

## GATE RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRGm</td>
<td>Peak reverse gate voltage</td>
<td>This value may exceeded during turn-off</td>
<td>-</td>
<td>16</td>
<td>V</td>
</tr>
<tr>
<td>IFGM</td>
<td>Peak forward gate current</td>
<td>-</td>
<td>100</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>PF(AV)</td>
<td>Average forward gate power</td>
<td>-</td>
<td>20</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>PRGM</td>
<td>Peak reverse gate power</td>
<td>-</td>
<td>24</td>
<td>kW</td>
<td></td>
</tr>
<tr>
<td>dI_{GO}/dt</td>
<td>Rate of rise of reverse gate current</td>
<td>30</td>
<td>60</td>
<td>A/$\mu$s</td>
<td></td>
</tr>
<tr>
<td>t_{ON(min)}</td>
<td>Minimum permissible on time</td>
<td>50</td>
<td>-</td>
<td>$\mu$s</td>
<td></td>
</tr>
<tr>
<td>t_{OFF(min)}</td>
<td>Minimum permissible off time</td>
<td>100</td>
<td>-</td>
<td>$\mu$s</td>
<td></td>
</tr>
</tbody>
</table>

## THERMAL AND MECHANICAL RATINGS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_{th(j-hs)}</td>
<td>Thermal resistance – junction to heatsink surface</td>
<td>Double side cooled DC</td>
<td>-</td>
<td>0.014</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single side cooled Anode DC</td>
<td>-</td>
<td>0.0233</td>
<td>°C/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cathode DC</td>
<td>-</td>
<td>0.035</td>
<td>°C/W</td>
</tr>
<tr>
<td>R_{th(c-hs)}</td>
<td>Contact thermal resistance</td>
<td>Clamping force 36.0kN With mounting compound Per contact</td>
<td>-</td>
<td>0.0036</td>
<td>°C/W</td>
</tr>
<tr>
<td>T_{vj}</td>
<td>Virtual junction temperature</td>
<td>On-state (conducting)</td>
<td>-40</td>
<td>125</td>
<td>°C</td>
</tr>
<tr>
<td>T_{op}/T_{stg}</td>
<td>Operating junction/storage temperature range</td>
<td>-40</td>
<td>125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>F_m</td>
<td>Clamping force</td>
<td>28.0</td>
<td>44.0</td>
<td>kN</td>
<td></td>
</tr>
</tbody>
</table>
CHARACTERISTICS

\( T_j = 125^\circ C \) unless stated otherwise

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{TM} )</td>
<td>On-state voltage</td>
<td>At 3000A peak, ( I_{G(ON)} = 10A ) d.c.</td>
<td>-</td>
<td>3.75</td>
<td>V</td>
</tr>
<tr>
<td>( I_{DM} )</td>
<td>Peak off-state current</td>
<td>( V_{DRM} = 4500V, V_{RG} = 0V )</td>
<td>-</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{RRM} )</td>
<td>Peak reverse current</td>
<td>( V_{RRM} = 16V )</td>
<td>-</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>( V_{GT} )</td>
<td>Gate trigger voltage</td>
<td>( V_D = 24V, I_T = 100A, T_j = 25^\circ C )</td>
<td>-</td>
<td>1.2</td>
<td>V</td>
</tr>
<tr>
<td>( I_{GT} )</td>
<td>Gate trigger current</td>
<td>( V_D = 24V, I_T = 100A, T_j = 25^\circ C )</td>
<td>-</td>
<td>3.5</td>
<td>A</td>
</tr>
<tr>
<td>( I_{RGM} )</td>
<td>Reverse gate cathode current</td>
<td>( V_{RGM} = 16V, ) No gate/cathode resistor</td>
<td>-</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>( E_{ON} )</td>
<td>Turn-on Energy</td>
<td>( V_D = 3000V )</td>
<td>-</td>
<td>2860</td>
<td>mJ</td>
</tr>
<tr>
<td>( t_d )</td>
<td>Delay time</td>
<td>( I_T = 3000A, \frac{di_T}{dt} = 300A/\mu s )</td>
<td>-</td>
<td>2.1</td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( t_r )</td>
<td>Rise time</td>
<td>( I_{FG} = 40A, ) rise time &lt; 1.0( \mu s )</td>
<td>-</td>
<td>4.8</td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( E_{OFF} )</td>
<td>Turn-off energy</td>
<td>( I_T = 3000A, V_{DM} = V_{DRM} )</td>
<td>-</td>
<td>12000</td>
<td>mJ</td>
</tr>
<tr>
<td>( t_{gs} )</td>
<td>Storage time</td>
<td></td>
<td>-</td>
<td>25</td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( t_{gf} )</td>
<td>Fall time</td>
<td>( I_T = 3000A, V_{DM} = V_{DRM} )</td>
<td>-</td>
<td>2</td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( t_{gq} )</td>
<td>Gate controlled turn-off time</td>
<td>Snubber Cap ( C_S = 4.0\mu C )</td>
<td>-</td>
<td>27</td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( Q_{GO} )</td>
<td>Turn-off gate charge</td>
<td>( \frac{di_{GO}}{dt} = 40A/\mu s )</td>
<td>-</td>
<td>12000</td>
<td>( \mu C )</td>
</tr>
<tr>
<td>( Q_{GQT} )</td>
<td>Total turn-off gate charge</td>
<td></td>
<td>24000</td>
<td>( \mu C )</td>
<td></td>
</tr>
<tr>
<td>( I_{GQM} )</td>
<td>Peak reverse gate current</td>
<td></td>
<td>-</td>
<td>800</td>
<td>A</td>
</tr>
</tbody>
</table>
**Fig. 2** Maximum gate trigger voltage/current vs junction temperature

**Fig. 3** On-state characteristics

**Fig. 4** Maximum dependence of $I_{CM}$ on $C_s$

**Fig. 5** Maximum (limit) transient thermal impedance - double side cooled
Fig. 6 Surge (non-repetitive) on-state current vs time

Fig. 7 Turn-on energy vs on-state current

Fig. 8 Turn-on energy vs forward gate current

Fig. 9 Turn-on energy vs rate of rise of on-state current

Conditions:

- $T_j = 125^\circ C$, $I_T = 3000A$
- $C_s = 4.0uF$
- $R_s = 10$ Ohms
- $\frac{dI_T}{dt} = 300A/\mu S$
- $\frac{dI_{FG}}{dt} = 40A/\mu S$
- $V_D = 3000V$
- $V_D = 2000V$
- $V_D = 1000V$

Conditions:

- $T_j = 125^\circ C$, $I_T = 3000A$
- $C_s = 4.0uF$, $R_s = 10$ Ohms
- $\frac{dI_T}{dt} = 300A/\mu S$
- $\frac{dI_{FG}}{dt} = 40A/\mu S$
- $V_D = 3000V$
- $V_D = 2000V$
- $V_D = 1000V$
On-state current $I_T$ (A)
Turn-on delay time, $t_d$, and rise time, $t_r$ - (us)

Conditions:
$T_j = 125^\circ$C; $I_{FGM} = 40$A
$C_s = 4.0\mu$F; $R_s = 10$ Ohms
$\frac{di_T}{dt} = 300$A/$\mu$s
$V_d = 2000$V

Fig.10 Delay and rise time vs on-state current

Peak forward gate current $I_{FGM}$ (A)
Turn-on delay time, $t_d$, and rise time, $t_r$ - (us)

Conditions:
$IT = 3000$A
$T_j = 125^\circ$C
$C_s = 4.0\mu$F
$R_s = 10$ Ohms
$\frac{di_T}{dt} = 300$A/$\mu$s
$\frac{di_{FG}}{dt} = 40$A/$\mu$s
$V_D = 3000$V

Fig.11 Delay and rise time vs peak forward gate current

Turn-off energy per pulse $E_{OFF}$ (mJ)
On-state current, $I_T$ (A)

Conditions:
$T_j = 125^\circ$C
$C_s = 4.0\mu$F
$\frac{di_{GO}}{dt} = 40$A/$\mu$s
$V_{DM} = 100\% V_{DRM}$
$V_{DM} = 75\% V_{DRM}$
$V_{DM} = 50\% V_{DRM}$

Fig.12 Turn-off energy vs on-state current

Turn-off energy per pulse $E_{OFF}$ (mJ)
Rate of rise of reverse gate current $\frac{dI_{RO}}{dt}$ (A/$\mu$s)

Conditions:
$T_j = 125^\circ$C
$C_s = 4.0\mu$F
$IT = 3000$A
$V_{DM} = 100\% V_{DRM}$
$V_{DM} = 75\% V_{DRM}$
$V_{DM} = 50\% V_{DRM}$

Fig.13 Turn-off energy loss vs rate of rise of reverse gate current
On-state current $I_T$ (A)

Turn-off energy per pulse $E_{OFF}$ (mJ)

$C_S = 4 \, \mu F$
$C_S = 3 \, \mu F$
$C_S = 2.5 \, \mu F$
$C_S = 2 \, \mu F$

Conditions:
$T_j = 125 \, ^\circ C$
$V_{DM} = V_{DRM}$
$\frac{dI}{dGQ}/dt = 40 \, A/\mu s$

Gate storage time $T_{gs}$ (us)

$T_j = 125 \, ^\circ C$
$T_j = 25 \, ^\circ C$

Gate fall time $T_{gf}$ (us)

$T_j = 125 \, ^\circ C$
$T_j = 25 \, ^\circ C$

Rate of rise of reverse gate current $\frac{dI}{dGQ}/dt$ (A/\mu s)

On-state current $I_T$ (A)
1.1 Rate of rise of reverse gate current \( \frac{dI_{GQ}}{dt} \) - (A/us)

1.2 Gate fall time \( t_{gf} \) - (us)

Conditions:
- \( I_T = 3000 \text{A} \)
- \( C_s = 4.0 \mu \text{F} \)
- \( T_j = 125 \, ^\circ \text{C} \)
- \( T_j = 25 \, ^\circ \text{C} \)

Fig. 18 Gate fall time vs rate of rise of reverse gate current

Fig. 19 Peak reverse gate current vs on-state current

2.1 On-state current \( I_T \) - (A)

2.2 Peak reverse gate current \( I_{GQM} \) - (A)

Conditions:
- \( C_s = 4.0 \mu \text{F} \)
- \( \frac{dI_{GQ}}{dt} = 40 \text{A/us} \)
- \( T_j = 125 \, ^\circ \text{C} \)
- \( T_j = 25 \, ^\circ \text{C} \)

Fig. 20 Reverse gate current vs rate of rise of reverse gate current

Fig. 21 Turn-off gate charge \( Q_{GO} \) - \( \mu \text{C} \)

Conditions:
- \( C_s = 4.0 \mu \text{F} \)
- \( \frac{dI_{GQ}}{dt} = 40 \text{A/us} \)
Fig. 22 Turn-off charge vs rate of rise of reverse gate current

Fig. 23 Rate of rise of off-state voltage vs gate cathode resistance
Fig. 24 General switching waveforms

Recommended gate conditions:

$I_{COM} = 1000\text{A}$

$I_{FG} = 30\text{A}$

$I_{G(ON)} = 4\text{A d.c.}$

$t_{w1(mín)} = 10\mu\text{s}$

$I_{GQM} = 420\text{A}$

$\frac{dI_{GQ}}{dt} = 30\text{A/μs}$

$Q_{GQ} = 9000\mu\text{C}$

$V_{RG(\text{min})} = 2\text{V}$

$V_{RG(\text{max})} = 16\text{V}$

These are recommended Dynex Semiconductor conditions. Other conditions are permitted according to users gate drive specifications.
PACKAGE DETAILS

For further package information, please contact Customer Services. All dimensions in mm, unless stated otherwise. DO NOT SCALE.

Nominal weight: 1400g  
Clamping force: 31.5 ±10%  
Lead length: 600mm  
Package outline type code: C

Fig.31 Package outline
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The products must not be touched when operating because there is a danger of electrocution or severe burning. Always use protective safety equipment such as appropriate shields for the product and wear safety glasses. Even when disconnected any electric charge remaining in the product must be discharged and allowed to cool before safe handling using protective gloves.

Extended exposure to conditions outside the product ratings may affect reliability leading to premature product failure. Use outside the product ratings is likely to cause permanent damage to the product. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture, a large current to flow or high voltage arcing, resulting in fire or explosion. Appropriate application design and safety precautions should always be followed to protect persons and property.

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We annotate datasheets in the top right hand corner of the front page, to indicate product status if it is not yet fully approved for production. The annotations are as follows:-

Target Information: This is the most tentative form of information and represents a very preliminary specification. No actual design work on the product has been started.

Preliminary Information: The product design is complete and final characterisation for volume production is in progress. The datasheet represents the product as it is now understood but details may change.

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Web: http://www.dynexsemi.com

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